

TOMEX Plus: Turbulent Oxygen Mixing Experiment Plus

Completed Technology Project (2017 - 2020)



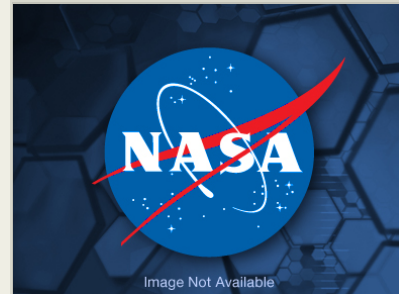
Project Introduction

The Turbulent Oxygen Mixing Experiment Plus (TOMEX+) is a sounding-rocket investigation proposed to the Low-Cost Access to Space portion of the Heliophysics Technology and Instrument Development for Science segment of the ROSES-2016 Research Announcement (appendix B.3). The specific science questions that will be addressed by the investigation include understanding the role of turbulence and other atmospheric disturbances in the dynamics and mixing of the upper atmosphere, and the characterization of these disturbances in three dimensions. TOMEX+ investigates atmospheric mixing in the mesosphere-lower thermosphere (MLT) using newly-developed ultraviolet lidar technology. The new technology, based on the ideas of McIlrath et al. [1979], directly resolves atomic oxygen density at fine scales. The investigation deploys the new lidar on a spinning sounding rocket to probe atomic oxygen density within a three-dimensional volume of the MLT. The investigation builds on the successful TOMEX sounding-rocket investigation of 2000 [Hecht et al., 2002] by augmenting its in-situ and ground-based measurements with the rocket-borne lidar measurements and state-of-the-art modeling capabilities. This work is motivated by the Heliophysics Division's goal to understand how geospace responds to a variable Sun. Specifically, this investigation will explore the physical processes in the space environment that work to mix the upper atmosphere, and will advance our understanding of the connections that link the Sun and the Earth's atmosphere.

Anticipated Benefits

Support NASA's strategic objectives to understand the Sun and its interactions with Earth and the solar system, including space weather. This will be achieved by developing/demonstrating instrumentation technology necessary to address the following science goals:

- Explore the physical processes in the space environment from the Sun to the Earth and throughout the solar system;
- Advance our understanding of the connections that link the Sun, the Earth, planetary space environments, and the outer reaches of our solar system;
- Develop the knowledge and capability to detect and predict extreme conditions in space to protect life and society and to safeguard human and robotic explorers beyond Earth.



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Primary U.S. Work Locations and Key Partners

Organizations Performing Work	Role	Type	Location
Aerospace Corporation	Lead Organization	R&D Center	El Segundo, California
The Aerospace Corporation	Supporting Organization	R&D Center	California

Organizational Responsibility

Responsible Mission Directorate:

Science Mission Directorate (SMD)

Lead Organization:

Aerospace Corporation

Responsible Program:

Heliophysics Technology and Instrument Development for Science

Project Management

Program Director:

Roshanak Hakimzadeh

Program Manager:

Roshanak Hakimzadeh

Principal Investigator:

James Clemmons

Co-Investigators:

William T Lotshaw
Steven M Beck
David C Fritts
Miguel Larsen
Todd Rose
Xiaodong Mu
Paul Steinvurzel
Richard Walterscheid
Xinzhaoh Chu
James H Hecht
Steve D Rhee

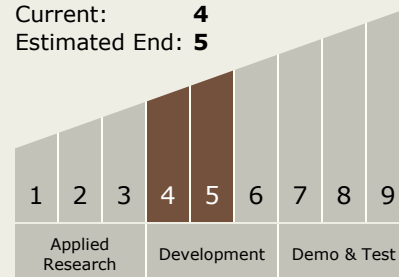
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Technology Maturity (TRL)

Start: **4**
Current: **4**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
 - └ TX08.1 Remote Sensing Instruments/Sensors
 - └ TX08.1.3 Optical Components

Target Destination

The Sun